NRI research highlights

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Sheep Aid Researchers Seeking Bovine Food Safety for Humans

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What do sheep have to do with hamburger? Researchers at the University of Idaho are investigating the relationship between cattle and the infamous *Escherichia coli* O157:H7 "hamburger-disease" bacterium. The use of sheep is speeding their progress.

A well-publicized 1993 U.S. outbreak of food poisoning was found to be linked to contaminated, undercooked hamburger at a restaurant chain. More than 700 people became ill – most of them in the Seattle area – and four children died of complications. The culprit was *E. coli* O157:H7.

The Center for Disease Control in Atlanta, GA, estimates that there are up to 40,000 *E. coli* O157:H7 infections in the U.S. each year. Most go unreported in the media because most occur at home – not at public eateries.

HEALTHY SHEEP ARE SIMILAR TO CATTLE IN THEIR RELATIONSHIP WITH THE HUMAN PATHOGEN *E. COLI* O157:H7 AND CARRY IT TRANSIENTLY AND SPORADICALLY IN THEIR GASTROINTESTINAL TRACT.

AGRICULTURAL RESEARCH SERVICE, USDA

LINKS TO FOOD SAFETY

USDA's National Research Initiative (NRI) Competitive Grants Program is supporting basic research at the University of Idaho to find the link between *E. coli* O157:H7 and consumer infection to stop it at its source.

Most of these infections are linked to a bovine food product – either undercooked contaminated beef or unpasteurized dairy products. Healthy cattle transiently carry this bacterium in their gastrointestinal tract without becoming sick.

Little is known about why *E. coli* O157:H7 grows in cattle or what causes animals to clear it from their system. The researchers are working to understand

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the "how" and "why" of the relationship between *E. coli* O157:H7 and cattle – and they're using sheep to do it.

The researchers discovered that a ruminant other than cattle could carry *E. coli* O157:H7. They found that healthy sheep are colonized by this human pathogen and – like cattle – sheep are culture-positive for *E. coli* O157:H7 sporadically and transiently. The occurrence is seasonal – highest in the warmer months.

This seasonality of culture-positive ruminants correlates with the incidence of human infection as well. Cases of human infection with *E. coli* O157:H7 linked to lamb meat or sheep in the U.S. are almost non-existent. However, the use of sheep for research is important.

WHY SHEEP?

Using sheep as a model ruminant to study the relationship between *E. coli* O157:H7 and cattle came about because sheep are less expensive, less genetically diverse, and easier to handle than cattle. In practical terms this means that larger, statistically significant numbers of animals can be included in experiments at less cost.

Of course, the animals of primary interest are cattle, since they are the link to human disease. All sheep research results are confirmed in experiments with smaller numbers of cattle.

Results support the hypothesis that pre-harvest cattle feed management determines the risk of *E. coli* O157:H7 contamination in bovine food products. For example, hay-fed sheep and cattle that are experimentally inoculated with a single dose of *E. coli* O157:H7 shed bacteria um over a longer period of time than do grain-fed animals.

Experiments are underway to identify the physiological and/or biochemical conditions in the gastrointestinal tract that favor or prohibit *E. coli* O157:H7 growth and persistence.

Furthermore, researchers found that *E. coli* O157:H7 survives only an average of 30 days in the ruminant gastrointestinal tract, but for at least 2 years in raw manure (under fluctuating environmental conditions). Such information helps to redefine understanding of *E. coli* O157:H7 and indicates that it needs to include the farm environment.

IMPACT

The research goal is to decrease the incidence of *E. coli* O157:H7 foodborne illness by reducing the risk that contaminated bovine food products will reach consumers. The research may identify practical pre-harvest management guidelines for cattle diet and manure handling to ensure that all animals entering processing plants are free of *E. coli* O157:H7.

The research reported in this factsheet was sponsored by the Food Safety Program of the Nutrition, Food Safety, and Health Division of the National Research Initiative Competitive Grants Program. To be placed on the mailing list for this publication or to receive additional information, please contact the NRI (202/401-5022 or NRICGP@reeusda.gov). The factsheet is accessible via the NRI section of the Cooperative State Research, Education, and Extension Service website (www.reeusda.gov/nri).